

## CLAIMS

What is claimed is:

1        1. A system for detecting underwater buried objects comprising:  
2              an acoustical camera adapted to produce three dimensional volumetric images of an  
3                  underwater target area volume of an underwater floor;  
4              an acoustic transducer adapted to apply an acoustic pulse to the target area volume  
5                  so as to cause displacement of materials included in the target area volume;  
6              and  
7              a controller adapted to coordinate operation of the camera and the acoustic  
8                  transducer, wherein a first volumetric image of the target area volume is  
9                  produced before the acoustic pulse is applied, and a second volumetric  
10                 image of the target area volume is produced while the acoustic pulse is  
11                 present in the target area volume.

1        2. The system of claim 1 wherein the camera produces volumetric images of  
2        the underwater target area volume at a real-time frame rate.

1        3. The system of claim 1 wherein the camera is further adapted to operate in  
2        an interferometer mode having a resolution of less than one wavelength.

1        4. The system of claim 1 wherein the controller is further adapted to compare  
2        volumetric images for evidence of at least one of a partially or completely buried object.

1        5. The system of claim 4 wherein the evidence of buried objects is based on  
2        movement of floor materials relative to the buried objects.

1        6. The system of claim 1 further comprising:  
2              an image recorder adapted to record the volumetric images.

1        7. The system of claim 1 wherein the acoustical transducer is extendible  
2        towards the target area volume.

1        8. The system of claim 1 further comprising:

2       an image discrimination module adapted to discriminate interesting objects from  
3                   non-interesting objects detected in the volumetric images.

1       9.      The system of claim 1 further comprising:

2                   a range finder adapted to detect when the system is at a proper distance from the  
3                   target area volume for imaging purposes.

1       10.     The system of claim 1 wherein the camera is configured for producing  
2                   volumetric images within a 16 feet range at a frame rate greater than 10 frames/second, the  
3                   camera having an acoustical lens configured for forming images on an array of acoustical  
4                   transducer elements.

1       11.     A system for detecting underwater buried objects comprising:

2                   an acoustical camera adapted to produce three dimensional volumetric images of an  
3                   underwater target area volume of an underwater floor;

4                   an acoustic transducer adapted to apply an acoustic pulse to the target area volume  
5                   so as to cause displacement of materials included in the target area volume;  
6                   and

7                   a controller adapted to coordinate operation of the camera and the acoustic  
8                   transducer, so that a volumetric image of the target area volume is produced  
9                   while the acoustic pulse is present in the target area volume, thereby  
10                  allowing buried objects to be detected based on relative movements in the  
11                  target volume area.

1       12.     The system of claim 11 wherein the camera is further adapted to operate as  
2                   an acoustical imaging interferometer having a resolution of less than one wavelength.

1       13.     A method for detecting underwater buried objects comprising:

2                   producing one or more three dimensional volumetric images of an underwater  
3                   target area volume of an underwater floor;

4                   applying an acoustic pulse to the target area volume so as to cause displacement of  
5                   materials included in the target area volume; and

6 producing one or more second volumetric images of the target area volume while  
7 the acoustic pulse is present in the target area volume.

1 14. The method of claim 13 wherein producing volumetric images of the  
2 underwater target area volume is performed at a real-time frame rate.

1 15. The method of claim 13 wherein producing volumetric images of the  
2 underwater target area volume is performed using a resolution of less than one wavelength.

1 16. The method of claim 13, further comprising:

2 comparing volumetric images for evidence of at least one of a partially or  
3 completely buried object.

1 17. The method of claim 16 wherein comparing volumetric images for evidence  
2 of buried objects includes detecting movement of floor materials relative to the buried  
3 objects.

1 18. The method of claim 13 further comprising:

2 recording the volumetric images.

1 19. The method of claim 13 further comprising:

2 discriminating interesting objects from non-interesting objects detected in the  
3 volumetric images.

1 20. The method of claim 13 further comprising:

2 detecting a proper distance from the target area volume for imaging purposes.